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Desalination of Seawater by Reverse Osmosis (Ro) Method

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Abstract:- Reverse osmosis membrane technology has developed over the past 40 years to a 44% share in world desalting production capacity, and an 80% share in the total number of desalination plants installed worldwide. The use of membrane desalination has increased as materials have improved and costs have decreased. Today, reverse osmosis membranes are the leading technology for new desalination installations, and they are applied to a variety of salt water resources using tailored pretreatment and membrane system design. Reverse Osmosis (RO) will continue to be used worldwide; as a new technology in energy recovery and renewable energy, as well as innovative plant design, will allow greater use of desalination for inland and rural communities, while providing more affordable water for large coastal cities.

Keywords:- *Desalination, Drinking water, Membranes, Seawater, Reverse Osmosis ,Saline water.*

I. INTRODUCTION

Water is a critical issue for the survival of all living organisms. Some can use salt water but many organisms including the great majority of higher plants and most mammals must have access to fresh water to live.

Humans cannot drink saline water. But, saline water can be made into freshwater, which everyone needs every day. Desalination refers to any of several processes that remove some amount of salt and other minerals from saline water. It is being used more and more around the world to provide people with needed freshwater. As the population continues to grow, shortage of fresh water will occur more often, if only in certain locations. In some areas, salt water (from the ocean, for instance) is being turned into freshwater for domestic uses[2].

Out of all the water on Earth, saline water in oceans, seas and saline groundwater make up about 97% of it. Only 2.5–2.75% is fresh water, including 1.75–2% frozen in glaciers ice and snow 0.5–0.75% as fresh groundwater and soil moisture, and less than 0.01% of it as surface water in lakes swamps and rivers. Considering the availability of seawater (98% of the water on earth), desalination may represent a major solution when facing the future water scarcity problem.

Till date, the two major technologies that are used for desalination purpose are distillation (multi-stage flash MSF or multi-effect evaporation MEE) and membrane filtration (reverse osmosis RO). For a given potable water supply project, the choice between these desalination processes and other treatment alternatives is yet to be made on technical, economical or political criteria.

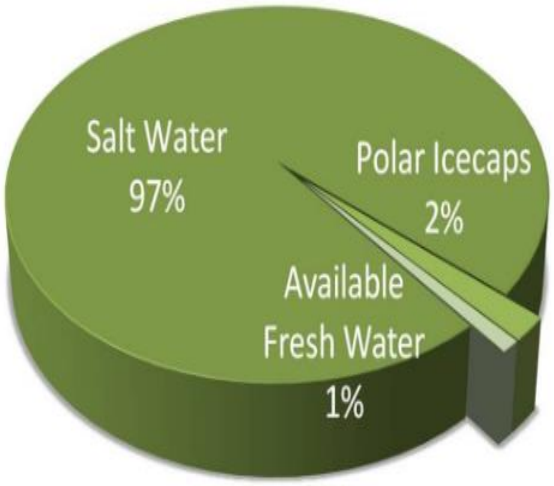

Fig 1:- Water on Earth

II. DESALINTION

Desalination is a process of removing dissolved salts from seawater to produce fresh water for consumption. The former technology features the use of a special filter (membrane) to produce desalinated water, whereas the latter technology involves the boiling/evaporation of seawater to give off water vapour which, on condensation yields salt-free liquid water. The saline feed-water is drawn from oceanic or underground sources. It is separated by the desalination process into the two output streams: the low-salinity product water and very saline concentrate streams. The use of desalination overcomes the paradox faced by many coastal

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communities, that of having access to a practically inexhaustible supply of saline water but having no way to use it[4].

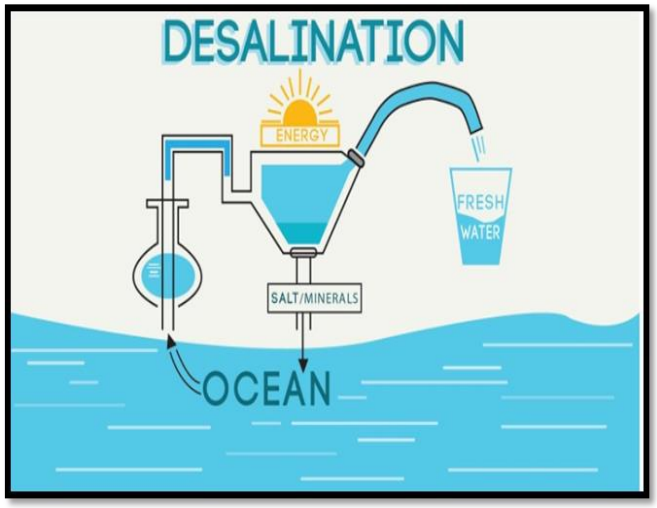

Fig 2:- Desalination

III. REVERSE OSMOSIS

Reverse Osmosis (RO) is a desalination process with the use of semi-permeable membranes which allows the passage of water molecules but not the dissolved salts.

In RO process, saline water is firstly pre-treated to remove suspended solids. Then a sufficient pressure is applied with the use of high pressure pumps to force the water to pass through the semi-permeable membranes, leaving the dissolved salts behind. The Desalinated water then undergoes post-treatment, such as pH adjustment and disinfection, to make it suitable for drinking.

Reverse Osmosis is primarily used to remove salts from brackish water or seawater, although RO is also capable of very high rejection of synthetic organic compounds.

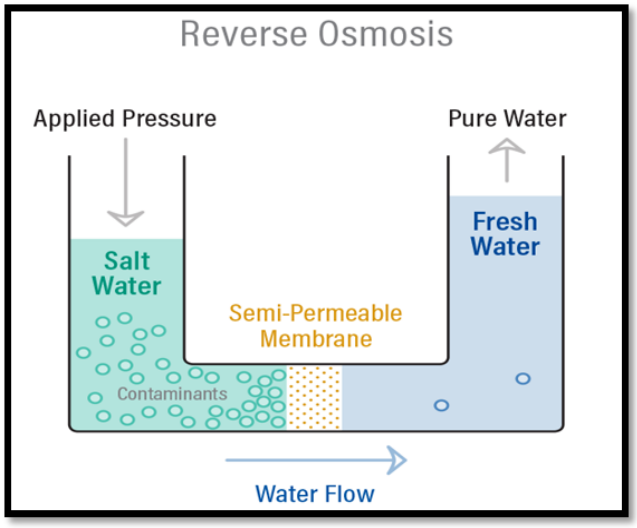

Fig 3:- Reverse Osmosis Process

IV. ADVANTAGES

- The membranes are sensitive to use.
- High level of pre-treatment is required in some cases.
- RO removes minerals and ions that provide taste to the water.
- Easy to clean
- This technique consumes less energy.

V. DISADVANTAGES

- The membranes are sensitive to use.
- High level of pre-treatment is required in some cases.
- RO removes minerals and ions that provide taste to the water.

VI. METHODOLOGY

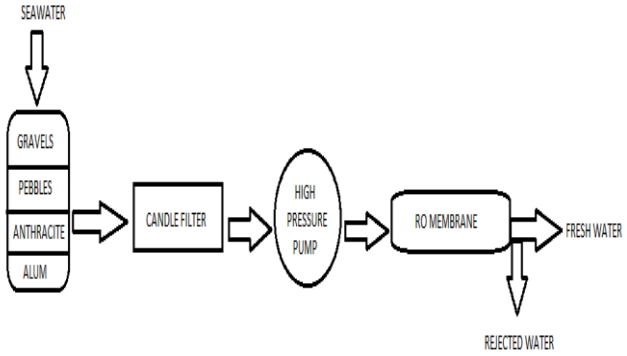

Fig 4:- The Process of Desalination for small scale model

A. Pretreatment

The saline water is passed through the cartridge filter to remove the suspended solid particles from it. Then it is passed through filter candles for purification. The primary objective of pretreatment to any RO membrane system is to make the feed water compatible with the membrane.

Inadequate membrane pretreatment results in high chemical cleaning costs, increased downtime, and permanent loss of performance with reduced membrane life. This is particularly true in seawater reverse osmosis (SWRO) desalination plants with open intakes where water quality parameters fluctuate. In many cases high salinity can also significantly reduce the efficiency of coagulation and flocculation to dual-media filters.

B. Pressurization

The pump is used to raise the pressure of pretreated feed water for passing it through the membrane.

C. Membrane Separation

The permeable membranes inhibit the passage of dissolved salts while permitting the desalinated product water to pass through. Applying feed-water to the membrane

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assembly results in a freshwater product stream and a concentrated brine reject stream. Because no membrane is perfect in its rejection of dissolved salts, a small percentage of salt passes through the membrane and remains in the product water.

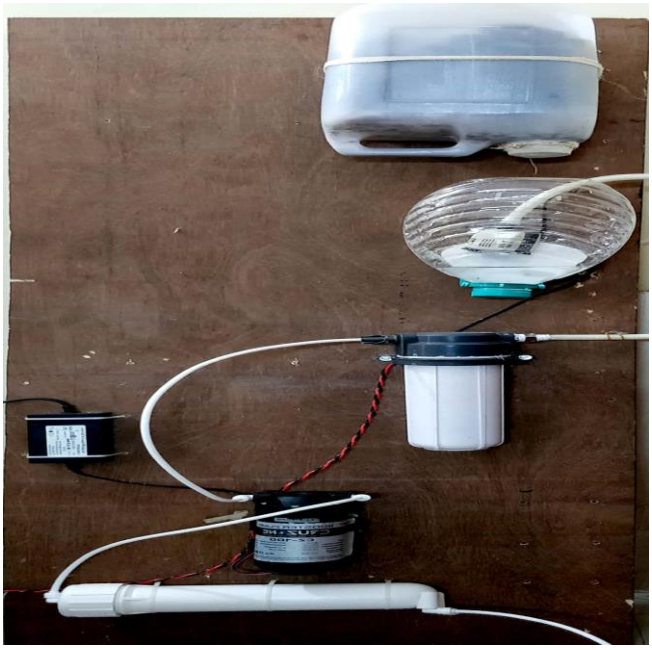

Fig 5:- Actual photograph of Small scale model for Desalination

VII. TESTING

Samples of saline water	Salinity before treatment in parts per thousand (ppt)	Salinity after treatment in parts per thousand (ppt)
1	35	25
2	30	22
3	25	17
4	20	11
5	10	0
6	35	25
7 Retreating (6)	25	18
8 Retreating (7)	18	13
9 Retreating (8)	13	9
10 Retreating (9)	9	5

VIII. RESULT AND CONCLUSION

As per testing of the various sample of feed water we came to a result that salinity of water is reduced upto 10-12 parts per thousand (ppt).

As a result salt water can be purified using Reverse Osmosis desalination process. Our process is based on small scale which can reduce salinity upto some extent. For better result this process can be used on a large scale to reduce the salinity.

Feed Water containing suspended particles, Organic matter as well as inorganic salt may deposit on the membrane and fouling will occur or damage the membrane because of applied pressure and size of particles Hence Membrane should be cleaned regularly

IX. FUTURE SCOPE

By increasing number of RO membranes more salinity from the feed water can be removed. The membranes should be placed in series arrangement. By using filter sediment filters, carbon filters, TDS filter we can obtain water which is much free from other impurities

. In India , around 63 million people living in coastal areas. The coastal areas have lowest per capita water availability in country. But in such regions, the sea water is available perennially, so the sea water desalination is a better option in future.

Desalination process primarily done by developed countries is enough money & resources. If technology continuous to produce new method & better solution to the issues that exit today, there would be a whole new water resources for more & more countries that are facing drought, completion for water and overpopulation. Now a days, sea water desalination is not widely used in India but as per seen the population, industrialization for next 30 years, desalination process is essential.

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